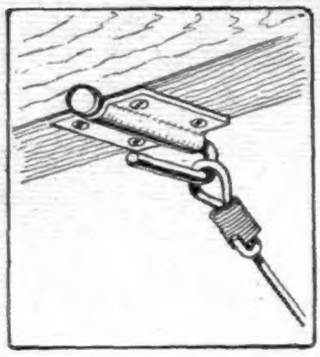
"Wilbur and Orville Wright literally suspended themselves in the air on a woodscrew . . . Since those early days aircraft construction has become finicking engineering."



STRUCTURAL

The Evolution of Aircra
Types of Win

By G. I

ENORMOUS progress in the structural design of aeroplanes has been made since the days when Wilbur and Orville Wright literally suspended themselves in the air on a woodscrew. To attach the main lift wires to a plate secured to the wing spar by woodscrews would not appeal to the Airworthiness Department at Farnborough, but that is what the Wright brothers did, and they suffered no harm thereby.

Since those early days aircraft construction has become finicking engineering. The beginning was made when, somewhere about 1922, the Air Ministry decided that after the lapse of a certain number of years no more aeroplanes of the "mixed" wood and metal construction would be accepted for use in the Royal Air Force. Sight is apt to be lost nowadays of the reasons which influenced the Air Ministry in arriving at that decision. So far as can be ascertained, no official pronouncement on the subject was ever published, although doubtless the aircraft firms were informed. It is fairly safe to assume that the experience of the war period was largely responsible. Silver spruce, mostly obtained from the Pacific Coasts of America and Canada, had been the chief structural material for wing spars during the war, and the available supplies had been sadly depleted by the enormous inroads made upon them by the wholly artificial demands of the war period.

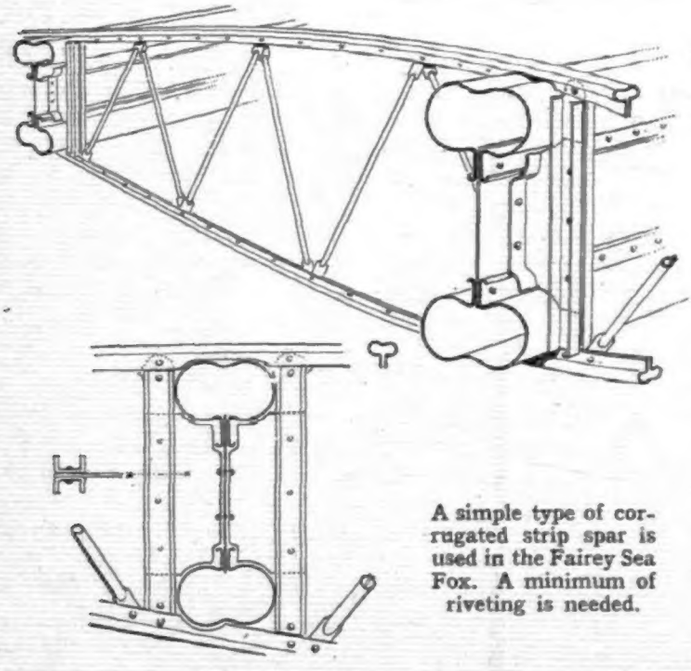
Whether or not the Air Ministry did well in stipulating that manufacturers must "go the whole hog" is, perhaps, open to argument. That this country should be dependent upon imported timber for its military aircraft was obviously undesirable, and as the available supplies were showing signs of giving out quite a good case could be made out for abandoning wood altogether. It is also possible that from fundamental considerations of the strength/weight ratios of wood and metal there may have been some idea that the metal aeroplane would be lighter for the same strength.

Early Efforts

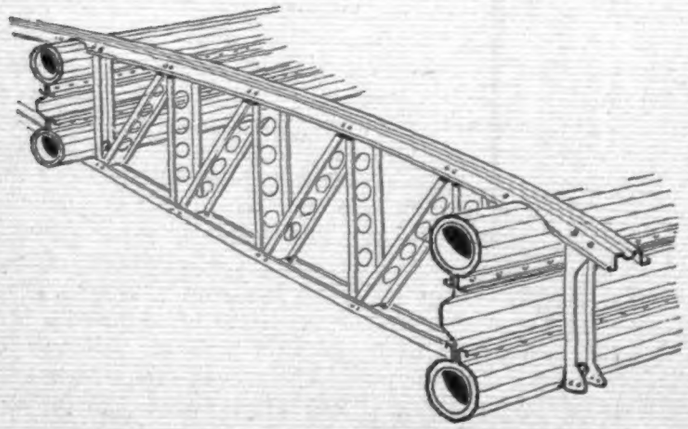
To appreciate the reasons why British all-metal aircraft construction developed in the way it did it is necessary to bear in mind that at the time when the Air Ministry made its decision to change over to metal every aeroplane in the Royal Air Force was a biplane. It was, therefore, perfectly natural that the designers should think in terms of the biplane structures to which they had been accustomed and that their first efforts should be directed towards "translating" their wood structures into metal.

Even Short Brothers, who have not been given nearly enough credit for their pioneer work in "stressed skin" construction, were at first tied to the biplane formula. At the first Olympia Aero Show after the war, in July, 1920, they exhibited a pretty little biplane, the *Silver Streak*, in which the fuselage was a pure metal monocoque. The wings were not of stressed skin type in that the usual type of spars and ribs were used, and the thin duralumin covering was but a covering, but the idea was clearly there.

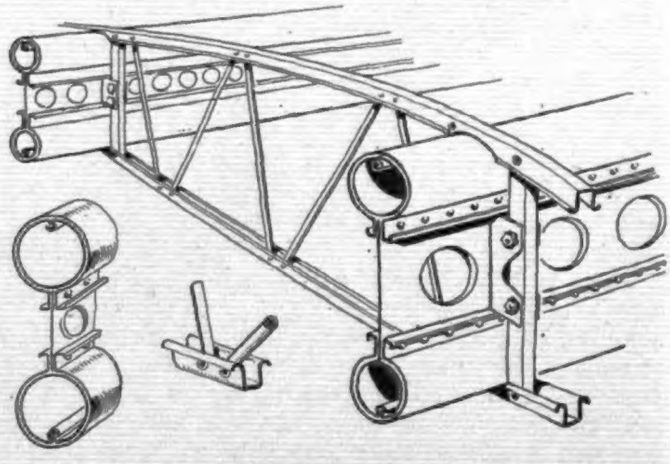
With this brief digression, let us return to the change-over from "mixed" to all-metal construction. Briefly explained, the general scheme on which designers worked was to take the old wooden structure and replace it, bit by bit, with its metal equivalent. In that way the old spindled I-section wing spar and the wooden box spar with spruce flanges and plywood walls became a box of



A simple type of corrugated strip spar is used in the Fairey Sea Fox. A minimum of riveting is needed.



In the Gloster Gladiator the sheet-metal spar web is stiffened by a corrugation running spanwise.



Another and slightly different type of construction is used in the Saro London biplane flying boat.